# ETHYLENE DICHLORIDE

Identified as a toxic air contaminant under California's air toxics program (AB 1807) in 1985.

CAS Registry Number: 107-06-2 $CH_2ClCH_2Cl$

Molecular Formula: $C_2H_4Cl_2$

Ethylene dichloride is a heavy, oily, liquid which burns with a smoky flame. Usually it is colorless but it will darken in the presence of air, moisture, and light. It has a pleasant chloroform-like odor and irritating vapors. Ethylene dichloride is slightly soluble in water and miscible with alcohol, chloroform, and ether (Merck, 1989). When in heated water, ethylene dichloride will corrode iron and other metals (HSDB, 1995).

**Physical Properties of Ethylene Dichloride**

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| Synonyms: | 1,2-dichloroethane; sym-dichloroethane; ethylene chloride; EDC; Dutch liquid; Brocide; 1,2-ethylene dichloride; ethane dichloride; Freon 150; Di-chlor-mulsion; glycol dichloride |
| Molecular Weight: | 98.96 |
| Boiling Point: | 83 - 84 $^oC$ |
| Melting Point: | -40 $^oC$ |
| Flash Point: | 56 $^oF$ (closed cup) |
| Vapor Pressure: | 64 mm Hg at 20 $^oC$ |
| Vapor Density: | 3.42 (air = 1) |
| Density/Specific Gravity: | 1.2569 at 20/4 $^oC$ |
| Log Octanol/Water Partition Coefficient: | 1.48 |
| Conversion Factor: | 1 ppm = 4.05 $mg/m^3$ |

(HSDB, 1995; Merck, 1989; Sax, 1989; U.S. EPA, 1994a)

## SOURCES AND EMISSIONS

A. Sources

In the past, ethylene dichloride was used in leaded gasoline as a scavenger of lead in the combustion exhaust (ARB, 1985b). Leaded gasoline is no longer sold for motor vehicle use in the United States and it will be phased out of use for aircraft starting in 1996 (ARB, 1993f).

As a pesticide, ethylene dichloride was widely used in California as a grain and food fumigant. However, in 1986 the United States Environmental Protection Agency (U.S. EPA) canceled or suspended under the Federal Insecticide, Fungicide, and Rodenticide Act registration of all fumigants that contain ethylene dichloride (DPR 1995). As of January 1, 1988, it is no longer registered for pesticidal use in California (DPR, 1996).

Ethylene dichloride is used in California as a reactant carrier in the production of solid fuel. It is also used in the manufacture of paints, coatings, and adhesives; solvent bonding of polycarbonate products; solvent extraction of seeds, animal fats, and pharmaceutical materials; cleaning polyvinyl chloride manufacturing equipment; preparation of polysulfide compounds; leaching copper ore; and the manufacture of film (ARB, 1985b).

The primary stationary sources that have reported emissions of ethylene dichloride in California are chemical manufacturers, manufacturers of aircraft and parts, and manufacturers of medical instruments and supplies (ARB, 1997b).

B. Emissions

The total emissions of ethylene dichloride from stationary sources in California are estimated to be to be at least 26,000 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Ethylene dichloride does not occur naturally in the environment (HSDB, 1995).

## AMBIENT CONCENTRATIONS

Ethylene dichloride was routinely monitored in California by the statewide Air Resources Board (ARB) air toxics monitoring network. The network's mean concentration of ethylene dichloride from July 1991 through June 1992 is estimated to be 0.40 micrograms per cubic meter ($\mu g/m^3$) or 0.10 parts per billion (ppb) (ARB, 1995c). In 1987, the ARB estimated ambient concentrations, by use of models, to be from 0.04 $\mu g/m^3$ (0.01 ppb) for 1986 to 0.02 $\mu g/m^3$ (0.005 ppb) for 1990 (ARB, 1987b).

The U.S. EPA has compiled ambient air data from various United States cities and recorded concentration means from less than 0.16 $\mu g/m^3$ (0.04 ppb) during 1989-90 to 1.61 $\mu g/m^3$ (0.40 ppb) from 1976-87 and concentrations ranged from less than 0.16 to 0.33 $\mu g/m^3$ (0.04 to 0.08 ppb) and from 0 to 74.7 $\mu g/m^3$ (0 to 18.4 ppb), respectively (U.S. EPA, 1993a).

## INDOOR SOURCES AND CONCENTRATIONS

Data on indoor concentrations of ethylene dichloride are extremely limited. A recent study, sponsored by the ARB, measured indoor levels of ethylene dichloride in 59 northern California homes during the summer of 1990. Only one of the 59 homes had ethylene dichloride concentrations above the study's limit of detection of 0.8 $\mu g/m^3$ (0.20 ppb). Results indicate that the home had a concentration of 0.95 $\mu g/m^3$ (0.23 ppb). These results suggest that few homes have measurable levels of ethylene dichloride. No information was available for outdoor concentrations (Sheldon et al., 1992).

A southern California in-vehicle study measured a mean ethylene dichloride concentration of 0.13 $\mu g/m^3$ (0.03 ppb) and a maximum concentration of 0.86 $\mu g/m^3$ (0.21 ppb) during the summer of 1987 and winter of 1988; about 3 times greater than what was measured in the ambient air during this study (Shikiya et al., 1989). However, since leaded gasoline has been banned in California since January 1992 and the rest of the United States since January 1996, in-vehicle concentrations of ethylene dichloride are expected to be similar to that of the ambient air.

## ATMOSPHERIC PERSISTENCE

In the troposphere, the dominant reaction of ethylene dichloride is with the hydroxyl radical. The calculated half-life for its gas-phase reaction with the hydroxyl radicals estimated to be about 45 days. Ethylene dichloride is therefore a persistent pollutant which undergoes long-range transport (Atkinson, 1995).

## AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics “Hot Spots” Program (AB 2588). Of the risk assessments reviewed as of April 1996, ethylene dichloride was the major contributor to the overall cancer risk in 3 of the approximately 550 risk assessments reporting a total cancer risk equal to or greater than 1 in 1 million and contributed to the total cancer risk in 70 of the these risk assessments. Ethylene dichloride also contributed to the total cancer risk in 17 of the approximately 130 risk assessments reporting a total cancer risk equal to or greater than 10 in 1 million (OEHHA, 1996a).

For non-cancer health effects, ethylene dichloride contributed to the total hazard index in 8 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1. Ethylene dichloride also contributed to the total hazard index in 2 of the approximately 107 risk assessments reporting a total acute hazard index greater than 1 (OEHHA, 1996b).

## HEALTH EFFECTS

Probable human exposure to ethylene dichloride occurs through inhalation and ingestion (U.S. EPA, 1994a).

Non-Cancer: Vapors are irritating to eyes and respiratory tract. Ethylene dichloride is highly nephrotoxic and hepatotoxic and a central nervous system (CNS) depressant at high levels. Immediate symptoms such as narcosis following acute inhalation exposure are related to CNS depression. Ethylene dichloride has induced cardiac arrhythmias. In test animals, chronic effects include histopathologic changes such as congestion and degenerative effects in the liver, spleen, kidneys, lungs, and adrenals (ARB, 1985b).

A chronic non-cancer Reference Exposure Level (REL) of 95 $\mu g/m^3$ is listed for ethylene dichloride in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered for chronic toxicity are the immune, kidney, and gastrointestinal systems (CAPCOA, 1993). The U.S. EPA has not established a Reference Concentration (RfC) or an oral Reference Dose (RfD) for ethylene dichloride (U.S. EPA, 1994a).

No information is available on adverse reproductive or developmental effects of exposure to ethylene dichloride in humans. Results from rat inhalation studies of ethylene dichloride have indicated adverse reproductive effects with an increased incidence of testicular lesions, increased embryo mortality, and decreased fertility (U.S. EPA, 1994a).

Cancer: Occupational studies have been inconclusive with respect to ethylene dichloride cancer risk. An increased evidence of colon and rectal cancer in men over 55 years of age exposed to ethylene dichloride in the drinking water has been reported but there were confounding exposures to other chemicals (ATSDR, 1993b). Rat gavage studies showed increases in carcinomas of the forestomach, hemangiosarcomas, fibromas of the subcutaneous tissue, and adenocarcinomas of the mammary gland. In mice there were increases in hepatocellular carcinomas and pulmonary adenomas in males and pulmonary adenomas, mammary carcinomas, and endometrial tumors in females (ARB, 1985b).

The U.S. EPA has classified ethylene dichloride in Group B2: Probable human carcinogen, based on sufficient animal but no human evidence, and has calculated an inhalation unit risk estimate of $2.6 \times 10^{-5}$ (microgram per cubic meter)$^{-1}$. The U.S. EPA estimates that if an individual were to breathe air containing ethylene dichloride at 0.04 $\mu g/m^3$, over a lifetime, that person would theoretically have no more than a 1 in 1 million increased chance of developing cancer (U.S. EPA, 1994a). The International Agency for Research on Cancer has classified ethylene dichloride in Group 2B: Possible human carcinogen, based on limited evidence in animals (IARC, 1987a).

The State of California has determined under Proposition 65 and AB 1807 that ethylene dichloride is a carcinogen (CCR, 1996; ARB, 1985b). The inhalation potency factor that has been used as a basis for regulatory action in California is $2.2 \times 10^{-5}$ (microgram per cubic meter)$^{-1}$

(OEHHA, 1994). In other words, the potential excess cancer risk for a person exposed over a lifetime to 1 $\mu g/m^3$ of ethylene dichloride is at most 22 in 1 million. The oral potency factor that has been used as a basis for regulatory action in California is $7.0 \times 10^{-2}$ (milligram per kilogram per day)$^{-1}$ (OEHHA, 1994).